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# RADIUM

A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY, PHYSICS AND THERAPEUTICS OF RADIUM AND OTHER RADIO-ACTIVE SUBSTANCES

SUBSCRIPTION $2.50 PER YEAR, OR 25 CENTS PER COPY IN THE UNITED STATES AND CANADA, IN ALL OTHER COUNTRIES $3.75 PER YEAR

VOL. II FEBRUARY 1914 NO. 5

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# RADIUM

A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY, PHYSICS AND THERAPEUTICS OF RADIUM AND OTHER RADIO-ACTIVE SUBSTANCES

PUBLISHED BY THE RADIUM PUBLISHING COMPANY
FORBES AND MEYRAN AVENUES, PITTSBURGH, PA.


We shall be glad to receive for publication from our subscribers and readers articles pertaining to the subject of radium and its application. All inquiries for information will be accorded prompt attention, and will be answered either by letter or through the columns of this paper.


VOL. II FEBRUARY, 1914 No. 5


## THE INTRAVENOUS INJECTION OF SOLUBLE RADIUM SALTS. II.


By FREDERICK PROESCHER, M.D.

*Director of the Laboratory for Experimental Therapy, Standard Chemical Company.*


In the following I wish to report the influence of the intravenous injection of soluble radium salts upon the blood of the polyarthritis cases.*

The blood counts were taken with the usual precautions, the haemoglobin was estimated with the Fleischel-Miescher Haemoglobinometer. For the differential counts the blood smears were stained for three minutes with a methyl alcoholic solution of eosin-methylen blue, toluidin blue, and then for fifteen minutes with Giemsa solution (1 drop to 1 cc. of water). This combined staining method differentiated in an excellent manner, the granulocytes (neutrophiles, eosinophiles, basophiles), and agranulocytes (lymphocytes, monocytes), as well as the regenerative and degenerative forms of erythrocytes. On the average 300 to 500 leucocytes were counted in each smear.

CASE No. 1.
Before Injection of Radium.

| Date | Haemoglobin | Red Cells | White Cells | Neutrophiles | Eosinophiles | Basophiles | Lymphocytes | Monocytes |
|---|---|---|---|---|---|---|---|---|
| 6–11–13 | 14.24 gr. | 5150000 | 8000 | 68.68 | 3.00 | 0.33 | 27.99 | ..... |
| 6–11–13 | 10 micrograms radium (element) intravenously. | | | | | | | |
| 6–12–13 | 15.00 gr. | 5150000 | 6750 | 60.50 | 1.00 | ..... | 35.75 | 1.00 |
| 6–13–13 | 10 micrograms radium (element) intravenously. | | | | | | | |
| 6–17–13 | 20 micrograms radium (element) intravenously. | | | | | | | |
| 6–21–13 | | 6425000 | 8750 | 67.50 | 0.25 | 2.00 | 30.25 | ..... |
| 6–25–13 | | 6200000 | 5250 | | | | | |
| 6–26–13 | | 6100000 | 5250 | | | | | |

*See preceding article by Dr. *Proescher*, in January number of RADIUM, in which reports were given on sixteen cases of arthritis treated by the intravenous injection of soluble radium salts.

CASE No. 2.

Before Injection of Radium.

| Date | Haemo-globin | Red Cells | White Cells | Neutro-philes | Eosino-philes | Baso-philes | Lympho-cytes | Mono-cytes |
|---|---|---|---|---|---|---|---|---|
| 7– 3–13 | 13.16 gr. | 5600000 | 11250 | 65.40 | 3.40 | 0.20 | 31.00 | ..... |
| | 7–3–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7– 5–13 | 11.26 gr. | 5550000 | 8700 | 61.00 | 3.50 | 0.75 | 34.50 | 0.25 |
| 7– 7–13 | 12.84 gr. | 6000000 | 5000 | 60.24 | 1.13 | ..... | 38.04 | 1.59 |

CASE No. 3.

Before Injection of Radium.

| Date | Haemo-globin | Red Cells | White Cells | Neutro-philes | Eosino-philes | Baso-philes | Lympho-cytes | Mono-cytes |
|---|---|---|---|---|---|---|---|---|
| 7– 2–13 | 10.04 gr. | 5200000 | 8725 | 64.10 | 0.60 | ..... | 32.90 | 1.20 |
| | 7–2–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7– 3–13 | 11.36 gr. | 4800000 | 7500 | 68.78 | 2.33 | 0.66 | 25.66 | 2.67 |
| 7– 4–13 | 11.36 gr. | 4950000 | 4000 | 50.62 | 3.60 | ..... | 43.63 | 2.15 |
| 7– 5–13 | 11.06 gr. | 4450000 | 8000 | 45.34 | 2.96 | 0.91 | 48.74 | 2.05 |
| 7– 7–13 | 6.84 gr. | 5250000 | 5000 | 55.58 | 2.44 | ..... | 41.32 | 0.66 |
| 7–11–13 | 13.16 gr. | 5800000 | 8750 | 65.40 | 2.40 | ..... | 29.00 | 3.20 |

CASE No. 4.

Before Injection of Radium.

| Date | Haemo-globin | Red Cells | White Cells | Neutro-philes | Eosino-philes | Baso-philes | Lympho-cytes | Mono-cytes |
|---|---|---|---|---|---|---|---|---|
| 7– 3–13 | 12.84 gr. | 4987500 | 8750 | 72.54 | 0.24 | 0.24 | 23.78 | 3.20 |
| | 7–3–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7– 4–13 | 13.16 gr. | 4750000 | 9500 | 80.76 | ..... | 0.20 | 18.23 | 0.81 |
| | 7–4–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7–10–13 | 8.96 gr. | 3900000 | 7250 | 66.56 | 2.37 | 0.19 | 27.12 | 3.76 |
| 7–11–13 | 8.96 gr. | 5800000 | 6750 | 69.55 | 2.03 | 0.67 | 20.98 | 6.77 |
| 7–14–13 | ..... | 5000000 | 10000 | 62.54 | 1.00 | 0.20 | 36.26 | ..... |

CASE No. 5.

Before Injection of Radium.

| Date | Haemo-globin | Red Cells | White Cells | Neutro-philes | Eosino-philes | Baso-philes | Lympho-cytes | Mono-cytes |
|---|---|---|---|---|---|---|---|---|
| 7–6 –13 | 9.84 gr. | 6250000 | 11000 | 67.16 | 2.07 | 0.17 | 29.74 | 0.86 |
| | 7–6–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7– 9–13 | 11.36 gr. | 5100000 | 11000 | 63.93 | 4.39 | 1.21 | 27.06 | 3.41 |
| 7–10–13 | 8.96 gr. | 6500000 | 12000 | 71.73 | 1.67 | 1.19 | 23.74 | 1.67 |
| 7–11–13 | 7.76 gr. | 5200000 | 10250 | 69.89 | 0.10 | 0.20 | 29.60 | 0.20 |
| 7–12–13 | 10.16 gr. | 5175000 | 10750 | 70.75 | 1.25 | ..... | 25.00 | 3.00 |
| 7–20–13 | 11.36 gr. | 5350000 | 13500 | 66.75 | 2.00 | ..... | 26.00 | 5.25 |

CASE No. 6.

Before Injection of Radium.

| Date | Haemo-globin | Red Cells | White Cells | Neutro-philes | Eosino-philes | Baso-philes | Lympho-cytes | Mono-cytes |
|---|---|---|---|---|---|---|---|---|
| 7–3– 13 | 16.16 gr. | 5425000 | 9375 | 69.25 | 1.25 | 1.00 | 25.75 | 2.50 |
| | 7–3–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7– 4–13 | 16.44 gr. | 5650000 | 6750 | 68.25 | 1.75 | 0.25 | 19.25 | 4.75 |
| 7– 5–13 | 16.44 gr. | 6500000 | 8500 | 63.25 | 1.75 | 0.50 | 29.50 | 0.05 |
| 7– 8–13 | 9.56 gr. | 6150000 | 5500 | 51.36 | 6.90 | 0.98 | 38.80 | 1.31 |
| | 7–8–13 | 50 micrograms radium (element) intravenously. | | | | | | |
| 7–10–13 | 9.56 gr. | 6000000 | 7000 | 69.44 | ..... | 0.70 | 27.98 | 1.88 |
| | 7–10–13 | 50 micrograms radium (element) intravenously. | | | | | | |
| 7–12–13 | 8.96 gr. | 6350000 | 7250 | 58.27 | 3.57 | 0.54 | 24.71 | 12.91 |
| 7–21–13 | 14.64 gr. | 4150000 | 9280 | 55.80 | 2.87 | 0.86 | 30.70 | 9.77 |

CASE No. 7.

Before Injection of Radium.

| Date | Haemoglobin | Red Cells | White Cells | Neutrophiles | Eosinophiles | Basophiles | Lymphocytes | Monocytes |
|---|---|---|---|---|---|---|---|---|
| 7- 8-13 | 14.36 gr. | 6150000 | 7500 | 55.40 | 1.60 | ..... | 40.60 | 2.40 |
| | 7-8-13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7- 9-13 | 8.96 gr. | 5800000 | 8000 | 66.10 | 1.92 | 0.72 | 31.26 | ..... |
| 7-20-13 | 14.96 gr. | 6050000 | 9750 | 63.00 | 1.25 | 0.25 | 34.50 | 1.00 |

CASE No. 8.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7-19-13 | 14.96 gr. | 5700000 | 8000 | 79.00 | 3.50 | 0.75 | 16.75 | ..... |

CASE No. 9.

Before Injection of Radium.

| Date | Haemoglobin | Red Cells | White Cells | Neutrophiles | Eosinophiles | Basophiles | Lymphocytes | Monocytes |
|---|---|---|---|---|---|---|---|---|
| 7- 5-13 | 11.64 gr. | 5450000 | 7250 | 66.50 | 2.50 | 0.50 | 27.25 | 3.25 |
| | 7-5-13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7- 7-13 | 14.04 gr. | 5125000 | 8250 | 69.50 | 0.75 | ..... | 25.00 | 4.75 |
| 7- 8-13 | 9.24 gr. | 4950000 | 5625 | 58.40 | 3.10 | ..... | 38.50 | ..... |
| 7-10-13 | 11.96 gr. | 6262500 | 5000 | 42.43 | 1.38 | 0.19 | ..... | 0.19 |

CASE No. 10.

Before Injection of Radium.

| Date | Haemoglobin | Red Cells | White Cells | Neutrophiles | Eosinophiles | Basophiles | Lymphocytes | Monocytes |
|---|---|---|---|---|---|---|---|---|
| 7- 4-13 | 15.96 gr. | 6650000 | 7500 | 46.00 | 2.25 | 1.25 | 50.00 | 0.50 |
| | 7-14-13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7-15-13 | 13.44 gr. | 6050000 | 9750 | 50.50 | 4.00 | 1.00 | 44.50 | ..... |
| 7-21-13 | 14.36 gr. | 5900000 | 8750 | 59.23 | 1.90 | 0.23 | 38.41 | 0.23 |

CASE No. 11.

Before Injection of Radium.

| Date | Haemoglobin | Red Cells | White Cells | Neutrophiles | Eosinophiles | Basophiles | Lymphocytes | Monocytes |
|---|---|---|---|---|---|---|---|---|
| 7- 8-13 | 10.76 gr. | 6875000 | 13000 | 71.97 | 2.81 | 0.70 | 20.78 | 3.74 |
| | 7-8-13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 7- 9-13 | 11.64 gr. | 6400000 | 9500 | 74.25 | 1.16 | ..... | 21.11 | 3.48 |
| 7-10-13 | 13.76 gr. | 5700000 | 7750 | 68.37 | 3.40 | 0.28 | 22.55 | 5.40 |
| 7-13-13 | 11.96 gr. | 5700000 | 10000 | 78.62 | 1.86 | 0.93 | 15.34 | 3.25 |

CASE No. 12.

Before Injection of Radium.

| Date | Haemoglobin | Red Cells | White Cells | Neutrophiles | Eosinophiles | Basophiles | Lymphocytes | Monocytes |
|---|---|---|---|---|---|---|---|---|
| 8-11-13 | 14.36 gr. | 4875000 | 9250 | 55.20 | 1.60 | 0.80 | 39.00 | 2.00 |
| | 8-11-13 | 50 micrograms radium (element) intravenously. | | | | | | |
| 8-13-15 | 14.04 gr. | 4500000 | 7750 | 53.03 | 1.11 | 0.44 | 41.99 | 1.77 |
| 8-14-13 | 13.24 gr. | 4700000 | 12000 | 65.44 | 1.76 | 0.07 | 32.54 | ..... |
| 8-15-13 | 8.96 gr. | 4100000 | 8250 | 60.59 | 2.33 | 0.58 | 32.14 | 1.36 |
| 8-16-13 | 14.04 gr. | 4300000 | 9250 | 63.36 | 1.49 | 0.99 | 34.16 | ..... |
| 8-18-13 | 12.24 gr. | 5400000 | 13750 | 62.50 | 1.80 | 0.25 | 37.25 | 0.05 |
| 8-20-13 | 14.96 gr. | 5650000 | 9750 | 53.63 | 0.63 | 0.21 | 27.02 | 0.42 |
| | 8-20-13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 8-21-13 | 13.16 gr. | 4850000 | 7000 | 58.95 | 0.85 | 0.85 | 38.08 | 1.27 |
| 8-22-13 | 13.76 gr. | 5250000 | 8250 | 62.57 | 1.97 | 0.49 | 34.97 | ..... |
| 8-23-13 | 16.16 gr. | 5500000 | 9740 | 63.70 | 1.34 | 1.34 | 32.95 | 0.67 |

CASE No. 13.

Before Injection of Radium.

| Date | Haemo-globin | Red Cells | White Cells | Neutro-philes | Eosino-philes | Baso-philes | Lympho-cytes | Mono-cytes |
|---|---|---|---|---|---|---|---|---|
| 8–13–13 | 13.16 gr. | 5900000 | 10500 | 59.41 | 4.67 | 0.98 | 32.24 | 2.70 |
| | 8–13–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 8–14–14 | 13.44 gr. | 5800000 | 11500 | 74.75 | 1.75 | 0.25 | 22.75 | 0.50 |
| 8–15–13 | 13.76 gr. | 5950000 | 16500 | 69.35 | 2.33 | 1.00 | 26.32 | 1.00 |
| 8–16–13 | 14.64 gr. | 6400000 | 12750 | 71.08 | 1.87 | 0.91 | 26.14 | ..... |
| 8–18–13 | 13.16 gr. | 5600000 | 12250 | 70.00 | 1.60 | 0.80 | 25.20 | ..... |
| 8–20–13 | 13.16 gr. | 5600000 | 12250 | 70.85 | 1.38 | 0.55 | 27.22 | ..... |
| 8–21–13 | 13.04 gr. | 5200000 | 11250 | 73.32 | 0.93 | 0.93 | 24.82 | ..... |
| 10–11–13 | 16.16 gr. | 6400000 | 15250 | 72.74 | 0.72 | 0.36 | 26.18 | ..... |

CASE No. 14.

Before Injection of Radium.

| Date | Haemo-globin | Red Cells | White Cells | Neutro-philes | Eosino-philes | Baso-philes | Lympho-cytes | Mono-cytes |
|---|---|---|---|---|---|---|---|---|
| 8–11–13 | 14.36 gr. | 4875000 | 9250 | 55.20 | 1.60 | 0.80 | 39.00 | 2.00 |
| | 8–11–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 8–12–13 | 14.04 gr. | 4500000 | 7750 | 53.03 | 1.11 | 0.44 | 41.99 | 1.77 |
| 8–14–13 | 13.24 gr. | 4700000 | 12000 | 65.44 | 1.76 | 0.07 | 32.54 | ..... |
| 8–15–13 | 8.96 gr. | 4100000 | 8250 | 60.59 | 2.33 | 0.58 | 32.14 | 1.36 |
| 8–16–13 | 14.04 gr. | 4300000 | 9250 | 63.36 | 1.49 | 0.99 | 34.16 | ..... |
| 8–18–13 | 12.24 gr. | 5400000 | 13750 | 62.50 | 1.80 | 0.25 | 37.25 | 0.05 |
| 8–20–13 | 14.96 gr. | 5650000 | 9750 | 53.63 | 0.63 | 0.21 | 27.02 | 0.42 |
| | 8–20–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 8–21–13 | 13.16 gr. | 4850000 | 7000 | 58.95 | 0.85 | 0.85 | 38.08 | 1.27 |
| 8–22–13 | 13.76 gr. | 5250000 | 8250 | 62.57 | 1.97 | 0.49 | 34.97 | ..... |
| 8–25–13 | 16.16 gr. | 5500000 | 9740 | 63.70 | 1.34 | 1.34 | 32.95 | 0.67 |
| 8–28–13 | 13.16 gr. | 5250000 | 6500 | 57.30 | 2.66 | 0.66 | 37.32 | 2.00 |
| 9–25–13 | 13.76 gr. | 6376000 | 8560 | 60.62 | 1.29 | ..... | 37.60 | 0.49 |

CASE No. 15.

Before Injection of Radium.

| Date | Haemo-globin | Red Cells | White Cells | Neutro-philes | Eosino-philes | Baso-philes | Lympho-cytes | Mono-cytes |
|---|---|---|---|---|---|---|---|---|
| 8–15–13 | 14.96 gr. | 4950000 | 6000 | 61.04 | 1.00 | 0.66 | 34.97 | ..... |
| | 8–15–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 8–16–13 | 14.64 gr. | 5000000 | 6750 | 73.54 | 0.99 | 1.23 | 24.24 | ..... |
| 8–18–13 | 14.96 gr. | 4950000 | 6500 | 61.00 | 1.00 | 0.25 | 36.75 | 0.25 |
| 8–20–13 | 15.84 gr. | 4350000 | 5500 | 62.76 | 0.63 | 0.31 | 36.30 | ..... |
| 8–21–13 | 14.96 gr. | 5000000 | 6750 | 62.37 | 3.92 | 0.46 | 33.25 | ..... |
| 9–29–13 | 16.44 gr. | 6025000 | 7000 | 66.71 | ..... | 0.66 | 30.65 | 1.98 |

CASE No. 16.

Before Injection of Radium.

| Date | Haemo-globin | Red Cells | White Cells | Neutro-philes | Eosino-philes | Baso-philes | Lympho-cytes | Mono-cytes |
|---|---|---|---|---|---|---|---|---|
| 9–25–13 | 16.40 gr. | 5840000 | 8400 | 51.43 | 6.88 | 0.28 | 40.79 | 0.57 |
| | 9–25–13 | 100 micrograms radium (element) intravenously. | | | | | | |
| 9–26–13 | 16.44 gr. | 5850000 | 8750 | 56.31 | ..... | ..... | 35.01 | 8.68 |
| 9–29–13 | 16.04 gr. | 6250000 | 7500 | 57.40 | 3.40 | 0.80 | 38.40 | ..... |
| 9–30–13 | 17.04 gr. | 5900000 | 8750 | 52.40 | 3.40 | 0.20 | 44.04 | 0.40 |
| 10– 1–13 | 16.76 gr. | 6650000 | 5000 | 53.78 | 2.51 | 0.19 | 43.52 | 0.19 |
| 10– 2–13 | 17.04 gr. | 6250000 | 8750 | 62.00 | 3.80 | 0.80 | 30.60 | 2.80 |
| 10– 3–13 | 16.84 gr. | 6200000 | 8250 | 47.50 | 2.75 | 0.25 | 48.25 | 1.25 |
| 10– 7–13 | 16.16 gr. | 6350000 | 7250 | 60.25 | 2.50 | 0.25 | 35.50 | 1.50 |
| 10–10–13 | 16.44 gr. | 6050000 | 8000 | 54.60 | 6.15 | 0.75 | 37.75 | 0.75 |
| 10–14–13 | 16.16 gr. | 6150000 | 6750 | 47.14 | 12.20 | 0.66 | 33.00 | 7.00 |
| 10–29–13 | 15.56 gr. | 5800000 | 7500 | 50.68 | 8.66 | ..... | 38.66 | 2.00 |

In subsequent articles will be given the effects of intravenous injections of radium salts upon the blood pressure in these cases of arthritis, following which will be a summary giving the general conclusions from the observed results.

## NOTES AND COMMENTS

Dr. Ernest *Rutherford*, Langworthy professor of physics in the University of Manchester, has been made a knight.

* * * * *

At a meeting of the Academy of Sciences at Vienna, December 13th, 1913, Prof. St. *Meyer* of the Vienna Radium Institute spoke of the "Secondary Radium Standards Prepared at the Vienna Radium Institute". The decision of the international committee for a Radium Standard was that each government which officially made application, should be provided with a "secondary radium standard" which would be compared with the Vienna and the Paris (international) radium standards. The Vienna Institute for Radium Research has undertaken the preparation of these standards, comparisons being made, independently, with the Vienna and the Paris standards, the accuracy of comparison being estimated at 0.5 per cent. Including one standard for Mme. *Curie* to replace the "international standard" which she prepared, there have been seven such secondary standards made, the following being a description of these standards:—

| Country | Date Sealed | Vienna Mgm. Ra | Paris $RaCl_2$ | Selected Value |
|---|---|---|---|---|
| France(Mme. *Curie*) | October 4, 1912. | 22.47 | 22.42 | 22.45 |
| Germany..... | " | 19.73 | 19.74 | 19.73 |
| England..... | " | 21.10 | 21.16 | 21.13 |
| United States..... | July 1st, 1913 | 20.29 | 20.28 | 20.28 |
| Sweden..... | " | 9.74 | 9.71 | 9.73 |
| Japan..... | " | 9.80 | 9.80 | 9.80 |
| Portugal..... | " | 9.07 | 9.11 | 9.09 |

The accuracy of measurement is probably greater than specified. The standards are accompanied by official certificates of the Commission, giving the quantity of the salt, the date of sealing, the radium content and the estimated accuracy of the measurement (0.2 to 0.3%). These certificates are signed by St. *Meyer*, certifying for the Vienna measurements, by Mme. *Curie* for the Paris measurements and by the president of the Commission, Ernest *Rutherford*.

* * * * *

The United States Bureau of Standards has received its secondary radium standard and now is prepared to make gamma ray determinations of quantities of radium in radium salts. For a schedule of fees charged for such measurements and other information address the Director, Bureau of Standards, Washington, D. C.

* * * * *

Mr. T. Thorne *Butler* in an interesting lecture before the Royal Society of Arts, of London, on the application of electricity and radium in agriculture said that a great deal of experimental work was going on with radio-active material, which gave in some cases such remarkable results that radium must be taken into consideration from an agricultural view. The residues resulting from radium extraction were sufficiently active to produce marked effects on germination and to greatly increase the size of the plants and crops. In some cases an increase of 300 and 400 per cent. had been obtained.

In the Berlin letter to the Journal of the American Medical Association for January 10th, 1914 a mention is made of a loan offered for the purchase of radium.

"A few days ago a conference took place in the department of the interior, under the presidency of the director of the Prussian Medical Bureau, of the representatives of numerous communes of greater Berlin, which was called at the request of Professor *His*, the director of the Radium Institute of the Charite. It was announced that certain insurance companies, the Landesversicherungsanstalten of Berlin and Brandenburg, had stated that they were ready to place at the disposal of the communes of greater Berlin a capital of $125,000 (500,000 marks), at a relatively low rate of interest, for the purchase of two grams of radio-active substances. The right is reserved to the communes participating to collect fees for radium treatment from patients who are able to pay. The representatives of the communes gave their consent, but the final decision naturally lies with the various communal corporations."

* * * * *

In giving a decision in regard to whether duty would need to be paid on a radium drinking water preparation, General Appraiser Brown says:—"When the Congress inserted in the act of 1909 the provision of the free list, using simply the word "radium", they must have meant to include more than the pure metal. According to the testimony in this case, radium does not occur in nature as the uncombined metal, and is not marketed for use as a medicine in that form but only in the form of its various salts, either dissolved in water, as in this case or mixed with some solid container. To hold in these circumstances that Congress meant only to admit free the pure metal radium, uncombined, would in our opinion render the provision in the free list meaningless.

Assuming that the salts of radium were intended to be allowed free entry, including the bromide, this plainly should not be excluded from the free list because dissolved in water".

* * * * *

Mrs. Lucy *Henderson* of New Castle, Pa., has donated a sum to the Jefferson Hospital, Philadelphia, Pa., the income of which is to be used in studying cures for cancer with special emphasis on the use of radium. The yearly income will approximate $3,500 and the fund will be known as the Lucy Henderson Foundation. The work of investigation for which the donation has been made will be carried on under the direction of Drs. J. Chalmers *DaCosta*, W. M. Late *Coplin* and Hobart Amory *Hare*.

* * * * *

The Crocker Research Cancer Laboratory at Columbia University has been completed and turned over to the commission headed by Dr. Frances Carter *Wood*, which will begin its work this month. The building is three stories and a basement in height and 100 by 35 feet.

* * * * *

According to the Chemiker Zeitung for December 23rd, 1913, the first Swiss Radium Institute has been founded in Geneva, the formal opening of this institute to take place in February, 1914.

## RADIUM AND RADIUM SALTS

The following is reprinted from page 41 of the January 3rd, 1914 number of the Journal of the American Medical Association.

"Radium is a bivalent metallic element closely related to barium. It is exceedingly reactive, making it difficult to isolate in its metallic state and after isolation to keep it in a pure state, as it reacts with air, forming the oxide, nitrite and finally the carbonate. On account of this activity it is only produced in the form of its salts, principally as the bromide, chloride, sulfate and carbonate.

The most important property of radium is its radio-activity upon which depends its therapeutic value. Radio-activity is defined as "the property of spontaneously emitting radiations capable of passing through plates of metal and other substances opaque to ordinary light and having the power of discharging electrified bodies". A spontaneous disintegration of the atoms characterizes all the radio-active elements and it is in this transmutation or splitting of the atom that the rays are shot out, some being material in nature, others electrical or of the nature of light. The spontaneous transmutation of radium is going on at a regular rate, which is independent of the state of combination of radium in the molecule of its compounds.

To determine the radio-active value of radium, use is made of its property of ionizing gases. Thus when radium is allowed to act on the air in a charged gold-leaf electroscope the air becomes ionized and therefore a conductor of electricity and allows the charge to leak out, causing the leaf in the electroscope to move. By observing the rate of movement of the leaf in a calibrated apparatus the radio-activity can be determined.

Quantities and concentrations of radium emanation are expressed in terms of "curies" and mache units. A "curie" is the amount of emanation in equilibrium with 1 gram of radium; a microcurie, one millionth of a "curie", is the amount of emanation in equilibrium with 0.001 mg. radium and is equivalent to about 2,500 mache units.

Relation of Radium, Radium Emanation and Rays.—The rays are largely derived indirectly from radium through the formation of its "active deposit", according to the following scheme:

$$\text{Radium} \begin{cases} \text{alpha particle} \\ \\ \text{emanation} \end{cases} \begin{cases} \text{alpha particle} \\ \\ \text{active deposit} \end{cases} \text{rays.}$$

These rays are divided into three groups, the alpha, beta and gamma, which differ in their velocity and penetrative power. The alpha and beta rays consist of minute particles of matter electrically charged and moving with a velocity almost equal to that of light. They are for the most part of relatively feeble penetrating power. The gamma rays are vibrations in the ether, very similar to X-rays, and of high penetrating power. Therapeutically the last group is the most useful.

Radium emanation is continuously given off from aqueous solutions of radium salts. It can be collected as it escapes from the solution, drawn off through the use of the mercury pump, or by other suitable means, quantitatively determined by either the alpha or gamma ray electroscope, brought into solution in water for internal or external

use or to be set free in an emanatorium for inhalation treatment. It may be collected into small glass containers and this used in place of the applicators described under surgical use.

Actions and Uses:—Radium emanation is said to increase the excretion of uric acid in the urine and to decrease its concentration in the blood; to increase somewhat the number of red blood-corpuscles; to cause temporary leukocytosis early in the course of treatment, the mononuclear increase being relatively greater; to lead frequently through long-continued use to leukopenia, although no appreciable benefit is observed in leukemia. It is said that radium increases general metabolism, and in vitro activates certain enzymes, pepsin, pancreatin, rennin, autolytic ferments, tyrosinase and diastase.

It has been claimed that radium emanation is of value in all forms of non-suppurative, acute, subacute and chronic arthritis (luetic and tuberculous excepted), in chronic muscle and joint rheumatism (so called), in arthritis deformans, in acute and chronic gout, in neuralgia, sciatica, lumbago, and in tabes dorsalis for the relief of lancinating pains. Its chief value is in the relief of pain.

Surgical Use:—The efficiency of the treatment is due to the beta and gamma rays. The quantity of ray is proportional to the amount of radium element represented in the salt or the emanation. Pure gamma rays may be employed when the apparatus is surrounded by at least 3 mm. of lead. Nearly all pathologic tissues are more sensitive than normal tissues. There is, however, a wide variation in the normal tissues; e. g. the ovary and the sexual organs are very sensitive, the eye and nervous tissues very unsensitive. In skin diseases marked results are obtained with epitheliomata, birth marks and scars.

Technic:—Usually heavy doses with epitheliomata, light doses with other conditions. New growths, benign and malignant, of the pelvic organs, the breast, the neck and other parts of the body have been most favorably influenced in some cases. The growths of the mucous membrane of the mouth are quite resistant. There is a remarkable sedative effect in true neuralgias, as well as those due to tumor pressure. The dosage for internal work is heavy, "hundreds of milligrams", and always with the pure gamma rays. The technic of filtration, of length of application and of amount is still in an experimental stage.

The radium salts and the emanation can be placed in any sealed container, but preferably in glass.

Dosage:—It may be administered as baths, by subcutaneous injection in the neighborhood of an involved joint (0.25 to 0.5 microcurie in 1 or 2 cc. distilled water), by local application as compresses (5-10 microcuries), by mouth as a drink cure (in increasing doses of from 1-10 to 10 microcuries three or more times a day), by inhalation, the patient for two hours daily remaining in the emanatorium, which contains 0.0025 to 0.25 (average 0.1) microcurie per liter of air.

RADIUM CHLORIDE.—Radium chloride is the anhydrous radium salt, $RaCl^2$, of hydrochloric acid. While nearly pure radium chloride, containing 76.1 per cent. radium (ra), is said to be obtainable, the market supply is a mixture of radium chloride and barium chloride and is sold on the basis of its radium content.

Actions and Uses:—See Radium.

Dosage:—See Radium.

Non-Proprietary Preparation:

Radium Chloride, Standard Chemical Company—Radium chloride is supplied in the form of a mixture of radium chloride and barium chloride for use in radium baths, radium drinking water and inhalatoriums. It is sold on the basis of its radium content.

Manufactured by the Standard Chemical Company, Pittsburgh, Pa. (The Radium Chemical Company, Pittsburgh, Pa.)

Pure anhydrous radium chloride occurs as a white or slightly brownish crystalline substance, soluble in water.

The presence of radium can qualitatively be demonstrated by electroscopic or by photographic methods.

The quantitative determination of radium is carried out according to the method of *Rutherford* and *Boltwood* (*Rutherford's* "Radio-active Substances and their Radiations").

RADIUM SULPHATE.—Radium Sulphate is the anhydrous radium salt $RaSO_4$, of sulphuric acid. While nearly pure radium sulphate, containing 70.2 per cent. (Ra), is said to be obtainable, the market supply is a mixture of radium sulphate and barium sulphate and is sold on the basis of its radium content.

Actions and Uses:—See Radium.

Dosage:—See Radium.

Non-Proprietary Preparation:

Radium Sulphate, Standard Chemical Co., Pittsburgh, Pa. (The Radium Chemical Co., Pittsburgh, Pa.).

Pure radium sulphate occurs as a white substance insoluble in water and dilute acids.

The presence of radium may be qualitatively determined by electroscopic or by photographic means.

The radium content may be determined as in the case of radium chloride."

## REPORTS ON THE THERAPEUTIC EFFECTS OF RADIUM IN CANCER.

Presented at the 85th meeting of the German Scientists and Physicians at Vienna, September 25, 1913.

Prof. G. *Riehl*, director of the radium station in the General Hospital at Vienna, speaking on the subject "Carcinoma and Radium"* described the equipment which is there available for the therapeutic use of radium. Founded in June 1912, a half gram of radium (element) was available for use, part being used as a source of emanation, the greater part being available in the form of applicators for the local application of radium rays. After the meeting at Halle, where the results of *Kroenig* and *Gauss*, *Bumm* and *Doederlein* in the treatment of cancer of the uterus with massive doses of radium excited the wonder of the medical world, the requests for larger quantities of radium became so pressing that in June 1913 an additional gram of radium was given to the Hospital. The radium station is not a separate institution but forms a center which makes it possible to use radium or emanation in all the sections of the Hospital, and for physical and

*Wiener klin. Wochenschrift, Vol. 26, p. 1645 (1913)

biological experiments. The treatment of the resident patients is wholly under the direction of the chiefs of the various clinics, which gives the patient the advantage of being treated by specialists in their various lines. By action of the Government it was made possible to lend the applicators to physicians for ray treatments. Complete physical data as regards each applicator was carefully recorded, according to the measurements of Prof. St. *Meyer* of the Vienna Institute for Radium Research, making it possible to carefully control the dosage applied. *Riehl* suggests that in the future the following data be given in describing the action of radium;

1.—the radium (element) content of the applicator.
2.—the extent and kind of screening.
3.—the size of the surface from which the rays come.

Unless the area over which the radium is spread and the area rayed is specified, the term "milligram hours" is a very unsatisfactory expression.

Beginning in July the additional gram of radium was available being placed in Dominici tubes, each containing 30, 50 or 100 mgm. of radium (element). Since these had to "age" for a month the maximum activity was not attained until in August. So the results with larger quantities are limited to the few weeks between this time and the latter part of September. However, the results attained in this brief time are so important from the standpoint of radium therapy that they are presented.

Unfortunately the first results with new therapeutic agents often lead to too great expectations and then shortly follows a pessimistic period of doubt. The results of a great many independent workers and of many series of experiments will most rapidly bring out the truth.

*Riehl* recommends aluminum and platinum filters since the secondary rays from these metals are less irritating than those from other metals frequently used.

Lately the view has prevailed that the action of the gamma rays on the tissues depends on the production of secondary rays. Experiments made to sensitise the carcinomatous tissue to the radium rays by the injection of various colloidal metals have so far been without satisfactory results since it has not been possible to infiltrate the tumor without getting the material into the surrounding tissue.

In order to make results comparable it is necessary to state the exact radium content of the preparation according to the International Standard.

Large skin cancers can be successfully influenced by means of lengthy intensive raying.

A purely selective action on carcinomatous tissues depends only upon sufficiently large doses, however, with long powerful raying even healthy tissues may become affected.

For superficial cancers, heavy screening as used in gynecology is of limited use, as the quantity of radium must be increased as well as the length of application.

*Wertheim** speaking on the subject of "Radium Treatment of Cancer of the Uterus" describes his results in 19 cases of cancer treated with radium and 3 cases treated with mesothorium. Of the nineteen cases, nine were inoperable, one case was on the border line

*Wiener klinische Wochenschrift, Vol. 26, p. 1648. (1913)

and nine were considered operable. Seven of the nine were operated upon, while in two cases due to the production of a retrovaginal fistula and a stricture of the rectum operation became impossible. The results of radium treatment in the inoperable cases were not so satisfactory. In all the cases however, *Wertheim*'s results show that radium has an effect on cancer of the uterus, as could be demonstrated macroscopically and microscopically. The radium treatment led to a complete disappearance of the growth, that is, a cure, only in those cases in which probably other operative treatment would achieve the same end. However, it is not to be said that radium treatment does not present certain advantages in such cases.

There is no doubt that radium produces rather far reaching effects. However, in very advanced cases the radium treatment is unlikely to cause complete disappearance of the growth. Effects on regional lymph glands that may be involved are not claimed but it is not impossible that there may be such an action. The bad action of intense raying expressed itself in weakness, emaciation, headaches, cardic weakness, diarrhea, elevated temperature, irritability and insomnia. *Wertheim* thinks that by careful screening and by improvement in the technic of application that these difficulties will be minimized. The experiments will be continued, however extraordinary care will be used, and two to three mm. of lead screening will be placed over the radium, the secondary rays from the lead being absorbed in thicknesses of paper, etc.

*Peham** discussing "Radium Treatment in Gynecology" told of twelve cases of carcinoma which he has treated since June 1913, working with 32 mgm. of radium (element). One case of carcinoma of the clitoris in which the tumor was the size of a small apple was completely cured, the tumor being replaced by a smooth scar tissue. In a case of carcinoma of the perineum the growth was reduced to a spot less than 0.5 cm. in diameter, a burn requiring the treatment to be discontinued for the time. Three cases of recurrences in cancer of the uterus following radical operations were little affected by the radium although in two cases the infiltrations became smaller. The remaining seven cases were of carcinoma of the uterus in which the local effects of the raying was proven both clinically and microscopically.

In conclusion *Peham* says that the direct ray treatment of cases of carcinoma of the female genitals is effective. It is not possible on the basis of present knowledge to say that radium is a specific in carcinoma and radium treatment is not to be recommended to replace the present operative methods. To treat an early cancerous growth with radium is not to be recommended as thereby the chances of recovery by an operation are lessened. In inoperable cases and recidives radium is to be recommended.

*Ranzi, Schueller* and *Sparmann*‡ speaking on the "Results of Radium Treatment of Malignant Tumors" reported on fifty-three cases. Of six cases treated with radium after operation, "preventive raying", three showed no recurrences and three showed recurrences. In the three cases where there was a recurrence, the radium was screened with 1 mm. thickness of gutta percha tissue and there was applied in toto, 133, 39 and 173 milligram hours of radium. These were three cases of tumor linguae. Of the 47 other cases treated all were inoperable save one case of carcinoma of the skin of the hand which was operated

*Wiener klinische Wochenschrift, Vol. 26, p. 1650 (1913)

‡Wiener klinische Wochenschrift, Vol. 26, p. 1651 (1913)

upon after the radium treatment had gone on for a while. Of the remaining 46, ten cases did not continue the treatment and so need not be considered. Of the thirty-six remaining, seven were recognized as utterly hopeless, because of the rapid growth of the tumors and the formation of metastases. Six other patients died during the treatment and in four of these cases only small doses had been applied. In three cases there was observed a disappearance of the carcinomatous nodules. In six other cases there was local improvement but the general condition of the patient became worse, and in three further cases the growths only increased as a result of the raying. These latter cases were a tumor colli, a carcinoma penis recidive and oesophageal stenosis, treated with 16920, 2400 and 937 milligram hours of radium respectively, using 2 mm. of silver in the first and third cases, the screening not being stated in the second case. In eleven cases still under treatment a beneficial effect of the rays was observed. These results lead the authors to conclude that in the action of radium there is not always the fulfilling of the hope that it would act selectively on the neoplasm, and care must be exercised not to cause perforations of hollow organs or hemorrhages due to erosion of blood vessels. The danger of infection after the perforation of the oesophagus, rectum, etc. is great. The general results of these fifty-three cases are rather disappointing. In spite of this it must be admitted that radium has improved eleven out of thirty-six cases of inoperable tumors. In any case radium is a valuable substance for the prevention of recurrences, when used post operatively. The use of radium in operable cases is not considered advisable.

*Dautwitz** in an article on "Radium Treatment in Surgery and Dermatology", draws the following conclusions from the radium treatment of hopelessly inoperable cases of cancer. Where all other means fail radium treatment benefits if only to make the suffering of the patient more endurable. The earlier a case is recognized as inoperable, the better the chances with radium treatment. Because of the specific effects of the radium rays on the cells of malignant growths it is well to use these rays after operations to prevent recurrences and metastases.

The necessarily large doses of rays required in inoperable cases may cause severe burns and other undesirable actions on the general condition of the patient, of which the patient should be warned. Radium should only be used in operable cases when the patient refuses operation.

## Reviews and Abstracts

C. J. *Gauss.* Technic of Mesothorium Therapy as Applied in Gynecology. Strahlentherapie. Vol. 3, pp. 348-364. Description of the various forms of applicators, screens and safety devices used in the application of the rays of radium or mesothorium in the University Gynecologic Clinic, Freiburg in Br. (Director, Dr. *Kroenig*).

Anton *Sticker.* Radium and Mesothorium Radiations. Theoretical Considerations and the Practical Therapeutic Application of These Rays. Strahlentherapie. Vol. 3, pp. 1-63. From the Surgical Clinic of the University of Berlin; Director, Dr. *Bier*, and the Radium Institute of the Royal Charite; Director, Dr. *His.* The author devotes thirty pages to a general discussion of the physical nature of the rays of the radio elements and their various physical and chemical effects. The

*Wiener klinische Wochenschrift, Vol. 26, p. 1662 (1913)

remainder of the paper is given to a discussion of the biologic effects of these rays and their practical application in therapeutics.

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L. *Wickham* and P. *Degrais.* Can Radium Aid Surgery in the Treatment of Malignant Tumors. Strahlentherapie. Vol. 3, pp. 457-472, 1913.

Lecture given at the 17th International Congress of Medicine in London, August 1913. "Our answer is wholly affirmative. Most assuredly radium can give valuable aid to Surgery in the treatment of malignant tumors." Immediate operation is recommended in all operable cases, raying the area afterwards to completely extirpate the last cells of the growth. This is a preventive measure against recurrence or metastases. In certain cases where an operation would be undesirable, radium alone can be used to remove the growth. In difficult operable cases, the use of radium before and after the operation is valuable. Tumors may be inoperable though accessible, or they may be inaccessible. This latter group is growing smaller day by day. As an example of the first group the tumors of the uterus may be cited, and in the second group cancerous growths in the larynx. Intensive raying with radium makes the first group operable, and can lead to the destruction of the growth in the second group. However, to put radium in the high place which it should have in aiding surgery in the fight against cancer many points must be kept in mind. Intensive raying through-out the whole of the neoplasm is necessary. This raying should be of equal intensity in all parts, particularly at the base and periphery of the growth. To attain this, surgical interference is of value. In addition to raying all the cells it is necessary that they be given adequate dosage so as to lead to their destruction. If this is not done the effect simply may be stimulating. Often poor results are due to a neglect of this point.

The quantity of radium to be used is a most important matter and must always be determined upon according to the radio-sensitibility of the tissue that is being rayed. We think that by an association of surgery and radium therapy a new science is constituted which will bring new aid to the sick by widening the field of surgery and of radium therapy.

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H. *Dominici.* The Receptivity of Normal and Pathological Tissues for Radium Raying. Strahlentherapie, Vol. 3, pp. 379-387, 1913.

Written as an introduction for *Barcat's* "Compendium of Radium Therapy". Maloine, Paris, 1912. By the word "receptivity" the author designates the ability of organic tissues to be acted on or changed by the action of the radium rays. This receptivity varies with the age and race of the cells and also many other fortuitous conditions. Embryonal or undifferentiated cells are destroyed by the action of the radium ray, whereas older further developed surrounding tissues simply undergo a simple or metabolic change. The different living elements show varying sensibility towards therapeutic raying. These effects of age and the species of the cell are to be seen in considering the effects of the rays on tumorlike neoplasms. Some of the growths are radio-sensitive such as the ectodermal baso-cellular epitheliomata of *Darier* and *Krompecher*, lymphadenomata, the pure sarcomata, and fibromata. In the other class of growths which are more or less resistent to the effects of raying are the squamous celled epitheliomata,

the fibro-sarcomata, chondro-sarcomata and osteosarcomata. The radium rays acting upon neoplasms cause a retardation of cell growth, a destruction of the cells and in some malignant cells a change which leads to the cell becoming normal. This latter change occurs in the cells which are least carcinomatous in nature. The involution of external or internal benign tumors and of superficial epitheliomata under the effects of radium rays when proper technic is used is generally quite definite.

With the carcinomata involving mucous surfaces of the inner organs the tendency is towards recurrences after an apparent cure which may last for several months or years. The recurrences are due mainly to cells of the original growth which were only lamed and not destroyed or to those cells which apparently became normal under the action of the rays. The author thinks as the technic improves that the number of refractory forms of carcinomata will diminish.

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P. *Degrais* and *Pasteau*. The Treatment of Prostatic Tumors with Radium. Strahlentherapie. Vol. 3, pp. 542-45, 1913. Operative treatment of carcinoma of the prostate has not given any too satisfactory results. Usually after a time the growth again develops, metastases form and there is a generalization of the carcinoma. The danger in an operation for the total extirpation of the prostate is also great. These considerations led the authors to try the effect of radium in such cases. Of 15 cases treated, six are still in the course of treatment. Among the cases treated were some which four years ago were considered hopeless.

Today, as a result of the radium treatment, the prostate is smaller in size, and movable. That these were malignant forms and not chronic prostatitis is not certain in all cases. In some however, there was the concomitant softening of the inguinal glands. One patient died later as a result of general metastases. In one case a very large and immovable prostate which could not be treated operatively, diminished under the influence of the radium treatment and became soft and movable. Operative treatment was then possible and sections showed the marked effects of the raying on the tissue, and confirmed the malignancy of the growth. The treatment with radium is simple, not dangerous, and if complete cures do not result, the improvement makes prostatectomy possible which before was impossible.

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Foveau de *Courmelles*. Roentgen and Radium Rays in Gynecology. Strahlentherapie. Vol. 3, pp. 388-407. The first part of this paper, dealing with the action of the X-rays, was given at the International Congress of Medicine, London, August 1913.

In this is summed up the work of the author and of many others on the use of the Roentgen rays in the treatment of myomata and fibromata. A brief summing of the author's work with radium in the treatment of uterus carcinomata, myomata, metritis, salpingo-ovaritis. The author in conclusion says that it must be understood that the X-rays and radium rays are not panaceas, and they can do damage. But rightly used, they are very valuable, and often a last resource.

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L. *Renon*, P. *Degrais* and L. *Dreyfus*. Radiumtherapy of Myelogenic Leukemia. Strahlentherapie. Vol. 3, pp. 551-52, 1913. Re-

ported at the 17th International Congress of Medicine, London, August, 1913.

Four cases of myelogenic leukemia which were not favorably influenced by X-ray or benzol therapy, and one case which had not been treated before, all responded in the same way to the following radium treatment. 300 to 330 milligrams of radium sulfate, covering an area of 500 to 600 sq. cm., screened with 2 mm. of lead, were applied for from 24 to 48 hours. The effect of the radium continues for 8 to 14 days after the application. The enlarged spleen diminishes to its normal size. The leucocyte count falls from 330,000 to 70,000 in five to ten days, the myelocytes disappearing. After three to four applications the leucocytes are normal, or even subnormal. The red blood cells increase, fever disappears, and the patient gains weight and becomes stronger. The patient is apparently cured, but only apparently, since in from 2 to 18 months after the treatment, the symptoms of leukemia reappear. When the radium treatment is again started the results obtained are different. The leucocytes count is not much changed, and the enlarged spleen diminishes only slowly. A tolerance to the radium seems to have been established. The patient succumbs; in two cases which the authors treated it was two years after the first radium treatment. The mechanism of the radium treatment is not known and the authors suggest that perhaps larger dosage and longer treatment at first might prevent the recurrence.

Perhaps a combined radium, X-ray and benzol treatment may give more permanent results. Certainly for rapid effects at first, radium gives remarkable results.

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L. *Wickham*, P. *Degrais* and A. *Bellot*. The Action of Radium upon Certain Hypertophic Conditions of the Skin. Strahlentherapie, Vol. 3, pp. 527-30, 1913.

Flat juvenile warts and senile warts were successfully treated by means of the unscreened rays from 1 centigram of radium sulfate (ca. 7 mgm. radium element), spread over an area of one square cm. in a varnish applicator. Five to ten minutes application caused the disappearance of the juvenile warts, whereas longer applications were required in the ordinary warts which usually resist most other forms of painless treatment. Warts and callous growths on the soles of the feet which often make walking very painful, if not impossible, can be successfully treated with radium. Thirty milligrams of pure radium sulfate (ca. 21 mgm. radium element) on an applicator having an area of six sq. cm., screened with two mm. of lead were applied on six nights for a total of sixty hours. In every case the result was good and the treatment painless.

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W. S. *Lazarus-Barlow*. The Action of Radio-active Substances and their Rays on Normal and Pathological Tissues. Strahlentherapie. Vol. 3, pp. 365-78. 1913.

A lecture given at the International Congress of Medicine in London, August, 1913—A resume of the author's work and that of his associates and others in this field. Too detailed to admit of a brief abstract.

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Paul *Lazarus*, Radium Therapy in Carcinoma. Berlin. klin. Wochenschrift, No. 28, July 14, 1913, pages 1304 and 1305. The author gives

his opinions as regards the treatment of carcinoma, particularly of the uterus. He advises the use of not less than 30 mgm. of radium sulfate (21 mgm. of radium element) nor more than 100 mgm. (70 mgm. radium element) radium sulfate, when one mm. of silver or lead is used to filter the rays. Smaller quantities of radium serve to stimulate growth, and the massive doses, unless heavily filtered, may injure the surrounding tissues. The author also worked with intravenous injections of thorium X and thorium X administered per os in cases of pseudo leukemia and sarcomatosis in abdomine. In the former the normal blood picture was restored and in the latter case, in spite of the multiple tumors still present, the patient has been working during the past $2\frac{1}{2}$ years. The permanent value of thorium X therapy still remains to be demonstrated.

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*Mache* and *Suess*. The Absorption of Radium Emanation by the Blood in Inhalation and Drinking Cures. IV International Congress of Physiotherapy, Berlin.

The authors conclude from their work, which was carried out in the Vienna Radium Institute, that the inhalation of radium emanation or the taking of radium emanation drinking water, will cause emanation to pass into the blood, and remain there for some time. The decision as to which method is more advantageous must be made rather on the basis of medical and practical reasons. The inhalation method affords the possibility of a more exact dosage, and does not have the effect of causing a localized accumulation of radium emanation, as is the case with the drinking cure. This latter recommends itself because of its convenience and low cost of application.

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*Ramsauer* and *Holthusen*. The Absorption of Radium Emanation in Blood. Strahlentherapie Vol. 2, p. 503–532. The authors find an absorption coefficient for radium emanation of from 0.295 to 0.325 in normal blood. This is about twice the absorption coefficient for radium emanation in water of the same temperature. The discordant values of the absorption coefficient of radium emanation in blood previously given have varied from less than the value for water up to thirty times this value. The authors find that the absorption coefficient varies with the composition of the blood—falling to 0.22 in anemia, and rising as high as 0.37 in hyperglobulia.

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